

(12) **UK Patent Application** (19) **GB** (11) **2 274 109** (13) **A**

(43) Date of A Publication 13.07.1994

(21) Application No 9300308.5

(22) Date of Filing 08.01.1993

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(51) INT CL⁵
C08K 3/20, C08L 77/00

(52) UK CL (Edition M)
**C3K KEF K124 K210
C3W W310
U1S S1362 S1384 S1420 S1565 S2053 S3011 S3052**

(56) Documents Cited
None

(58) Field of Search
**UK CL (Edition L) C3K KEB KEE KEF KEZ KFA KMA
KXX , C3V VDM VDS VDT VDX
INT CL⁵ C08K , C08L
ONLINE DATABASES:WPI**

(54) **Moulding compositions containing nylon**

(57) A moulding composition containing nylon and magnesium hydroxide which acts as a flame-retardant. In order to reduce surface defects in the moulding, the composition also contains caprolactam.

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MOULDING COMPOSITIONS CONTAINING NYLON

This invention is concerned with moulding compositions which contain nylon, e.g. nylon 6 or nylon 66, and is especially concerned with such compositions which contain magnesium hydroxide as a flame retardant.

Nylon is widely used for moulding components. Nylon 6 is produced from caprolactam with the polymerised product containing about 90% of nylon and about 10% of low molecular weight material such as the monomer. Before such a polymerised product is used for moulding, it is washed to remove the monomer. The unwashed product is known as "unwashed nylon" or as "high monomer nylon". In some moulding applications, it is desirable that the moulded component exhibits flame retardant characteristics. Such applications include electrical lamp-holders, and switch housings.

Magnesium hydroxide is a flame retardant which has been suggested for use with nylon. This material, when subjected to a flame, decomposes endothermically with the liberation of water. Nylon containing magnesium hydroxide has been found to be difficult to mould because of its high melt viscosity and, furthermore, it is found that the mouldings have obvious surface defects which render them unacceptable commercially. Such surface defects manifest themselves by the appearance of white patches on the surface of the moulding. Various attempts have been made to overcome this problem but without achieving complete success. The most successful previous attempt known to the applicants involves the addition of organic sulphonamide

(see GB 2,237,573A) but even this has not achieved total success.

It is an object of the present invention to provide a nylon moulding composition containing magnesium hydroxide as a flame retardant which produces mouldings which are substantially free of surface defects of the type referred to.

The invention provides a moulding composition containing nylon and magnesium hydroxide as a flame-retardant, wherein the composition also contains sufficient caprolactam to reduce the formation of surface defects in the moulding.

Mouldings made from a composition according to the invention are found to be substantially free of surface defects. Furthermore, such compositions are also found to be much easier to mould.

As nylon is prepared from caprolactam, the caprolactam can be provided by the use of unwashed nylon in the composition, possibly with the addition of further caprolactam. Alternatively, if the nylon has been washed, the caprolactam is added. The caprolactam may be present in up to 10% by weight e.g. between 1% and 5%.

A composition according to the invention may contain up to 60% by weight of magnesium hydroxide e.g. between 45% and 65%. Alternatively, if a lower flame retardant standard is acceptable, the composition may contain 20-45% by weight of magnesium hydroxide. The composition may also contain reinforcing fibres, e.g. glass fibres, which may be present in up to 35% by weight depending on the amount of magnesium hydroxide is present.

There now follows a detailed description of two moulding compositions which are illustrative of the invention.

The first illustrative composition contained 37.01% by weight of unwashed nylon which contained about 10% of caprolactam and about 2.5% of water. The composition also contained 0.30% by weight of calcium stearate (as a mould lubricate), 9.82% of glass fibre as a reinforcement, and 52.87% of magnesium hydroxide as a flame retardant. The constituents were mixed together in a blender and fed into a compounder through the main hopper. The compounder was a Baker Perkins 2030 twin screw extruder operating with a barrel temperature of 260°C (feed region at 180°C), a feed rate of 9 to 12 kg/hour, and a screw speed of 250 RPM. The material was found to be easy to extrude and the extruded strand did not break.

Test rods were injection moulded from the first illustrative moulding composition using a Battenfeld BA 750 CD Plus injection moulding machine. The barrel temperature was 280°C and the mould temperature 115°C. The test rods were easy to mould and were found to have a very good surface finish with hardly any defects.

The second illustrative composition contained 34.98% by weight of the same unwashed nylon as the first illustrative composition. It also contained 0.30% of calcium stearate, 14.75% of glass fibres, and 49.97% of magnesium hydroxide. It was mixed, compounded and injection moulded into test rods in the same way as the first illustrative composition. The mouldability and surface finish were substantially the same as for the first illustrative composition.

The second illustrative composition was moulded into lamp-holders and the surface finish was found to be

excellent. These lamp-holders also passed the Underwriters Laboratory Inc. flammability test (UL 94 test) with a rating of Vo at 1.5mm and had good impact strength.

For comparison purposes, a moulding composition falling outside the invention was mixed, compounded and injection moulded into test rods under the same conditions as the first and the second illustrative compositions. This composition contained 35.88% by weight of washed nylon 6, 0.35% calcium stearate, 10% glass fibre and 53.82% magnesium hydroxide. The material was difficult to extrude as strand breakage occurred, and was difficult to injection mould taking 10% longer. The test bar surfaces were covered in white marks.

CLAIMS

- 1 A moulding composition containing nylon and magnesium hydroxide as a flame-retardant, wherein the composition also contains sufficient caprolactam to reduce the formation of surface defects in the moulding.
- 2 A moulding composition according to Claim 1, wherein the caprolactam is provided by the use of unwashed nylon.
- 3 A moulding composition according to either one of Claims 1 and 2, wherein the caprolactam is present in up to 10% by weight.
- 4 A moulding composition according to any one of Claims 1 to 3, wherein the composition contains between 45% and 65% by weight of magnesium hydroxide.
- 5 A moulding composition according to any one of Claims 1 to 4, wherein the composition also contains reinforcing fibres.
- 6 A moulding composition substantially as hereinbefore described with reference to the first illustrative composition or the second illustrative composition.

**Examiner's report to the Comptroller under
Section 17 (The Search Report)**

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Relevant Technical fields

(i) UK CI (Edition L) C3K (KFA, KMA, KXX, KEB, KEE, KEF, KEZ)
C3V (VDM, VDS, VDT, VDX)
(ii) Int CI (Edition 5) C08K; C08L

Search Examiner

A J RUDGE

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

27 APRIL 1993

Documents considered relevant following a search in respect of claims ALL

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|------------------------|--|-------------------------|
| | NONE | |

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